

What is claimed is:

1. A reductase comprising

(i) an amino acid sequence of SEQ ID NO:1 having a substitution at amino acid position 54 or 104 or at both of the amino acid positions 54 and 104, or

(ii) an amino acid sequence defined in (i) having further deletion, substitution, or addition of an amino acid or acids.

2. A reductase according to claim 1, which comprises an amino acid sequence of SEQ ID NO:1 having a substitution at amino acid position 54 or 104 or at both of the amino acid positions 54 and 104, and further substitution of an amino acid or acids.

3. A reductase according to claim 1, wherein said single amino acid substitution is a single amino acid substitution at amino acid position 54.

4. A reductase according to claim 1, wherein said single amino acid substitution is a single amino acid substitution at amino acid position 104.

5. A reductase according to claim 1, wherein amino acids at amino acid positions 54 and 104 are substituted.

6. A reductase according to claim 3 or 5, wherein the amino acid at the position 54 is substituted with a non-aromatic amino acid.

7. A reductase according to claim 3 or 5, wherein the amino acid at position 54 is substituted by glutamine, glycine, serine, threonine, cysteine, asparagine, alanine, valine, isoleucine, methionine, lysine, arginine, aspartic acid, glutamic acid, tyrosine, proline or histidine.

8. A reductase according to claim 4 or 5, wherein the amino acid at the position 104 is substituted by cysteine.

9. A reductase according to claim 1, 2, 3, 4 or 5, wherein said further substitution comprises at least one
5 single amino acid substitution at amino acid positions 245 and 271 in the amino acid sequence of SEQ ID NO:1.

10. A reductase according to claim 9, wherein said further substitution comprises a single amino acid substitution at amino acid position 245 in the amino acid
10 sequence of SEQ ID NO:1.

11. A reductase according to claim 9, wherein said further substitution comprises a single amino acid substitution at amino acid position 271 in the amino acid sequence of SEQ ID NO:1.

12. A reductase according to claim 9 or 10, wherein the amino acid at amino acid position 245 is substituted by arginine.
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13. A reductase according to claim 9 or 11, wherein the amino acid at amino acid position 271 is substituted by aspartic acid.
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14. A reductase according to claim 1, wherein

(a) the amino acid at amino acid position 54 is substituted by glutamine and the amino acid at amino acid position 104 is substituted by cysteine;

25 (b) the amino acid at amino acid position 54 is substituted by glutamine,

the amino acid of the position 104 is substituted by cysteine and said further substitution comprises a substitution of the amino acid at amino acid position 271

by aspartic acid;

(c) the amino acid at amino acid position 54 is substituted by glutamine and

the amino acid at amino acid position 104 is
5 substituted by cysteine, and

said further substitution comprises

the amino acid substitution at amino acid position
245 by arginine, and

the amino acid substitution at amino acid position
10 271 by aspartic acid;

(d) the amino acid of the position 54 is substituted
by glutamine, and said further substitution comprises the
amino acid substitution at amino acid position 245 by
arginine;

15 (e) the amino acid of the position 54 is substituted
by glutamine, and

said further substitution comprises

substitution of the amino acid at amino acid position
245 by arginine, and

20 substitution of the amino acid at amino acid position
271 by aspartic acid; or

(f) the amino acid at amino acid position 54 is
substituted by glutamine and said further substitution
comprises substitution of the amino acid at amino acid
25 position 271 by aspartic acid.

15. A polynucleotide comprising a nucleotide sequence
that encodes the amino acid sequence of the reductase of
claim 1 or 9.

16. A vector comprising the polynucleotide according

to claim 15.

17. A transformant comprising the polynucleotide according to claim 15 or the vector according to claim 16.

18. A vector according to claim 16, which further
5 comprises a polynucleotide having a nucleotide sequence that encodes the amino acid sequence of a protein capable of converting NADP or NAD into NADPH or NADH.

19. A transformant according to claim 17, which further comprises a polynucleotide having a nucleotide
10 sequence that encodes the amino acid sequence of a protein capable of converting NADP or NAD into NADPH or NADH.

20. A production method for (S)4-halo-3-hydroxybutyrate ester, which comprises reacting 4-halo-3-oxobutyrate ester with the transformant according to claim
15 17 or 19, or a treated material thereof.

21. A method for modifying an enzyme, comprises substituting at least one single amino acid at amino acid positions 54 and 104 in the amino acid sequence of SEQ ID NO:1, thereby selectivity of said enzyme is improved.

20 22. A production method for a modified enzyme gene, which comprises replacing a codon that corresponds at least one of the amino acids of the positions 54 and 104 of an amino acid sequence of SEQ ID NO:1, with a codon that corresponds to the another amino acid(s), in a nucleotide
25 sequence that encodes the amino acid sequence of SEQ ID NO:1.